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Thesis

MATHEMATICS TEACHING IN THE PUBLIC HIGH SCHOOLS OF MASSACHUSETTS (1946 - 1947)

by

Gilbert Henry Johnson

(A.B., Boston University, 1947)

submitted in partial fulfillment of the
requirements for the degree of
Master of Arts

1948

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CHAPTER I

THE PROBLEM AND ITS BACKGROUND

I. STATEMENT OF THE PROBLEM

Purpose. The purposes of this thesis are (1) to get a clear picture of mathematics teaching in Massachusetts in the school year 1946-47 as reflected in the biennial high school survey for that year conducted by the Massachusetts Department of Education; (2) to determine from this the general conditions and characteristics with regard to the teaching staff and the courses offered, as an assistance to those who are responsible for preparing the teachers of tomorrow, and to anyone concerned with the teaching of mathematics; and (3) to discover what recommendations could be made to improve the part of the survey dealing with mathematics. It is the author's hope that this thesis will inspire others to investigate other parts of the survey.

II. BACKGROUND OF THE PROBLEM

History of the survey. Since 1916 the Massachusetts Department of Education has conducted a biennial survey of all the public high schools in the state. The purpose, as stated in the original survey, was "to compare conditions in high schools of different sizes."[1] In order to do this, the "255

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[1] Eighty-First Annual Report of the Board of Education, The Commonwealth of Massachusetts, January, 1918 (Boston, Mass.: Wright and Potter Printing Company, 1918), p. 41.

high schools were classified into five groups on the basis of the number of pupils."[2] The following table taken from the 1916 survey shows this grouping:

Table 8 - Grouping of High Schools[3]

	Membership about Dec. 1, 1916	No. of schools	No. of cities & towns represented
Group I	over 500	57	34
Group II	201 -500	46	46
Group III	101 -200	48	48
Group IV	51 -100	52	50
Group V	1 - 50	52	49

It is interesting to note that each group represented about a fifth of the schools in the state. This grouping remained in effect until the survey of 1946-47. At that time there were only nine high schools with less than fifty pupils. Therefore Group V was made a part of Group IV, which then included schools with one to one hundred pupils. It was impossible to obtain a copy of this first survey (only the current 1946-47 survey is on record), and the only information available was in the Eighty-First Annual Report of the Board of Education. According to this report, the 1916 survey discussed types of high schools, grouping of high schools, number of teachers, pupils per teacher, size of classes, retention of pupils, graduates who continued their education, promotion, length of school day, lunch or noon period, preparation of hot lunches, and subjects offered.[4]

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[2] Ibid., p. 41.

[3] Ibid., p. 43.

[4] Ibid., pp. 41-61.

Mr. A. Russell Mack, Supervisor of Secondary Education for the Commonwealth of Massachusetts,[5] found that the latest survey had some new questions not asked in other recent surveys-some on school libraries, and one on extra assignments to teachers such as guidance, coaching, etc. The 1946-47 survey covered 258 high schools. It was a seven page questionnaire booklet. It had sections on the school system, promotion, graduation, membership, high school schedule, sizes of classes, pupils' marks, records, and reports, building and equipment, pupils' organizations, courses, teaching staff school library, physical education, miscellaneous, blanks and printed matter requested, occupational guidance and placement, and remarks. Three copies of the survey were sent to each high school principal, filled out and signed by him and the superintendent, and one copy returned to the Supervisor of Secondary Education. The other two copies were retained in the offices of the principal and the superintendent.

Use of the survey. The latest reports are available at the office of the Supervisor of Secondary Education to all who have a professional interest in education. Superintendents, principals, and heads of departments who want to know what other schools are doing, often consult them. The only limitation on their availability is on those who out of idle curiosity would want to know the salary of a certain teacher or some

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[5] Interview with Mr. A. Russell Mack, Supervisor of Secondary Education for the Commonwealth of Massachusetts, March 29, 1948.

other personal information. Since Mr. Mack, the present Supervisor, talks to all who would like to use the files, he makes certain that they have a professional interest in them.[6]

An investigation of the theses in the Boston University library revealed that only two persons who were master's degree candidates looked into the possibility of using the results of the survey. One of them, who wrote his thesis on speech education, stated that the survey was inadequate, and therefore made up an original survey.[7] The other wanted to use the survey to find out which high schools had newspapers so that he could send them the questionnaire he had prepared. He also found the survey inadequate and used information from the Columbia Scholastic Press Association.[8] As far as could be determined, no one has attempted to use the survey as the sole basis for an investigation.

III. IMPORTANCE OF THE PROBLEM

Those teachers, principals, and supervisors who help fill out the biennial high school surveys for the Commonwealth of Massachusetts Department of Education might well have the

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[6] Interview with Mrs. Preston, secretary to Mr. A. Russell Mack, Supervisor of Secondary Education for the Commonwealth of Massachusetts, April 13, 1948.

[7] Quimby, C. P., "A Survey of Speech Education in the Secondary Schools of Massachusetts," (unpublished Master of Education thesis, Boston University, 1947) p. 2.

[8] Bradley Jr., Albert L., "An Analysis of Public High School Newspapers in Massachusetts," (unpublished Master of Education thesis, Boston University, 1947) p. 10.

feeling that they are wasting their time. If the school personnel must contribute their time and effort to gather this information, it should be so written as to demand a uniform and accurate response which will be valuable to all. This can be done only by a reevaluation of the questions asked on the questionnaire. As previously mentioned, there is little active use made of the assembled statistics. They are merely available at the office of the Supervisor of Secondary Education in the form in which they were gathered. There is a definite need for someone to interpret the statistics, or at least to make suggestions for the improvement of the survey. It is the author's feeling that it is a waste of the taxpayers' money if the material is not interpreted, for a survey is, as Whitney says, "an organized attempt to analyze, interpret, and report the present status of a social institution, group, or area."[9]

IV. PREVIEW OF THE ORGANIZATION OF THE THESIS

Scope. The survey takes in all 258 of the public high schools in Massachusetts. Certain schools omitted part of the information requested, but all of them made a return. When significant, omitted items have been noted as a part of the presentation. Only the mathematical aspects of the survey have been utilized.

This thesis does not account for all the courses of mathematics taught in high school. Since the commercial depart-

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[9] Whitney, Frederick L., The Elements of Research (New York: Prentice-Hall, Inc., 1946), p. 155.

ment was assumed to have jurisdiction over the commercial mathematics courses, they were not included. Although the mathematics department sometimes gives mechanical drawing, it is more often found in the industrial arts department and so has been left out. In this thesis, the remaining mathematics courses were considered a part of the mathematics department.

Due to the nature of the survey, there was no possibility of dealing with the subject matter included in the courses. Furthermore, the thesis has dealt with teacher preparation only as to degrees confirmed, for there is no way to find out the actual courses the teacher has taken. It has covered also teaching combinations, teacher salaries, teaching load, course selection, size of classes, and extra-curricular activities, as they pertained to mathematics.

Since the number of part time teachers amounted to under five per cent, part time teachers were not considered. The fractional amounts they would produce would not add significance to the investigation.

Because the survey gave us static material, the figures could not be used to indicate trends. Where equivalent studies were available, a comparison was made for this purpose.

Procedure. After receiving Mr. Mack's permission to use the survey, the first step was to obtain the data in a more usable form. Two mimeographed forms, which are parts A and B of the Appendix, were made to transfer the mathematical sections of parts IX, X, and XI of the survey entitled Pupils' Organizations, All Courses, and Teaching Staff, respectively. These

forms were necessary since the surveys could not be taken from Mr. Mack's office. Furthermore, the survey reports might be damaged by the constant turning of pages which would be required in tabulating the material. Two additional facts were added to the forms after they were mimeographed: the population of the school in the upper right hand corner, and the sex of the teachers to the left of the salary column in the margin. The first name of the teacher was used to determine the sex. Two names which were not separable were omitted.

The data was tabulated in two parts. Those statistics which dealt with the teachers were considered first; those which dealt with the courses and the extra curricular activities were considered second. This order is more or less arbitrary, but the author considered that the teacher is most interested in himself. Reasons for any method of tabulating the data will be given when the table is discussed.

A pattern has been kept of giving the data in its full form and, where it is appropriate, following this by a summary. Those tables designated by a number followed by the letter A or no letter are full forms. Other letters denote summarizations. In tabulating the data, an attempt has been made to avoid tables which are complicated and forbidding.

Instead of giving a history of similar studies here in the introduction, the author has chosen to introduce them in the chapters on the presentation of the data. When applicable this will enable the reader to make direct comparison and interpretations.

For the sake of easy reference to the survey, the grouping arrangement of the schools has been preserved. The two hundred fifty-eight schools covered by this survey are divided into groups as follows:

TABLE I

GROUPING OF SCHOOLS BY POPULATION

Group	No. of pupils	No. of schools
I	over 500	100
II	201 -500	61
III	101 -200	52
IV	100 or under	45
Total		258

From the outset it must be realized that the figures which are used from the survey are subject to misinterpretation or clerical error. However, if the survey has any value, the facts presented will give an approximate picture of mathematics teaching in Massachusetts as far as the teachers and the courses offered are concerned.

Organization. The thesis is organized into four parts. First, the data on the teachers has been tabulated and observations made as to salaries, preparation, teaching combinations, and teaching load. Second, the data on courses offered has been tabulated and observations made as to mathematics organizations, distribution of course selections, when courses are offered,

per cent of population in different courses, and number of schools offering the different courses. Third, the tabulations and observations have been interpreted and conclusions and recommendations made. Fourth, the abstract of the thesis has been presented.

CHAPTER II

PRESENTATION OF THE DATA: STATUS OF THE MATHEMATICS TEACHER

I. THE PURPOSE

The problem. In this chapter the author has described the situation of the mathematics teachers in Massachusetts in 1946-47, as revealed by the survey. Where comparable data were available, they have been brought in for later interpretation.

Materials and methods. Chapter II is based on tabulations of the data on the teaching staff covered by the mimeographed form appearing as Appendix A. This form was used to take the information from the original survey. From this collection of data Tables II, III, IV, V, VI, VII, VIII and IX were determined and the information tabulated. Not included in these tabulations were four schools that did not fill out this section of the survey. Then from the tabulations it was determined which tables should be accompanied by graphs for greater clarity and simplicity of comparison. The actual treatment of the tables has been included under the topic called *Tabulation*, which describes the method by which the material is divided.

Points to be covered. The first topic is the relation of the teachers' salaries, length of service, and academic preparation. Its purpose is to show how each of the three was related to each of the others.

Following this is an analysis of the teaching combina-

tions of those teachers who taught subjects in addition to mathematics. The purpose of this is to show how many there were of each teaching combination and how they compared with each other and with the group that taught only mathematics.

For the same purpose, a section is included in the topic on teaching combinations to show the combinations of the high school principals and vice-principals who taught mathematics.

The final topic in this chapter is the teaching load. This gives information on the size and number of the mathematics teacher's classes.

II. COMPARISON OF THE MATHEMATICS TEACHER'S SALARY, LENGTH OF SERVICE, AND ACADEMIC PREPARATION

Preliminary statement. For some time teachers have been seeking higher salaries to meet the rising cost of living. The teacher organizations have done their utmost to keep the public informed of the plight of the teachers. The following excerpt from a report by the N. E. A. is typical.

> At best the teachers will be handicapped by low buying power in the year ahead. They can wisely share in efforts to maintain existing price controls. Since it seems possible that prices and salaries alike may level off at something near present levels, teachers are under compulsion to seek further salary increases. Higher salaries are necessary merely to restore teachers' salaries to their postwar status in relation to other groups.
>
> Over and above this effort is a long time objective of raising teachers' salaries to professional standards.[1]

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[1] National Education Association (Research Division), "Prices and Salaries," Journal of The National Education Association, 35:586, December, 1946.

The New York Times[2] reported the annual salary of the teachers in the United States for 1946-47 as $2,026.

In another article by the N. E. A.[3] on the average salaries of teachers by states, the following figures show the average for Massachusetts in the years between 1919 and 1944.

1919-20	1923-24	1927-28	1931-32
$1262	$1637	$1823	$1845
1935-36	1939-40	1942-43	1943-44
$1834	$2037	$2205	$2219

It is interesting to note that the average salaries went up $375 in four years after World War I. The teachers of today are evidently familiar with their history. The topic under discussion has determined the salary levels of the teachers of mathematics before the cost of living raises went into effect.

There now seems to be a greater demand for teachers to have more training before going into teaching. The current mood has been stated by H. T. Karnes in his article on "The Preparation of Teachers of Mathematics." "It is highly desirable that the senior high school teacher have the master's

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[2] Fine, B., Survey comparing 1947-48 status with 1946-47 revised, item in The New York Times, January 4, 1948, IV, 9:1.

[3] National Education Association, "Teachers' Salaries by States," Journal of The National Education Association, 35:40, January, 1946.

degree. The trend is apparently toward its becoming a prerequisite for teaching at the senior high school level."[4] With this trend in mind, the position of the mathematics teacher can be determined from the assembled data.

The longevity of teachers in the field of mathematics has not been discussed anywhere in the literature to the author's knowledge. In this presentation the length of service has been established as a sidelight of its relation with salary and preparation.

Tabulation. In order to reduce the complexity of Table II, on which this section is based, certain material has been consolidated or omitted. Since the number of hours' credit which the teachers have earned in addition to their degrees is not consistently reported, Table II does not include this information. This inconsistency occurred in the column called "Graduate study." The numbers in this column were sometimes labeled in terms of years, semester hours or credits, courses, and no designation. Theoretically, the figures which were not labeled stood for years because the column is under the title "Years of study." Because the degree candidate must complete a certain number of hours and not necessarily years of study, the academic degree awarded was considered a more reliable indication of a definite amount of work completed. Those who had more than one degree of the same kind, i.e., two bachelor's

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[4] Karnes, H. T., "Preparation of Teachers of Secondary Mathematics," The Mathematics Teacher, 38:7, January, 1945.

degrees, are few in number and therefore room has not been taken to include this information. The degrees have been separated into the bachelor's degree and master's degree regardless of whether it is in education, liberal arts, business or law.

The author selected four year intervals for length of service since a smaller division would spread the data too thin and a larger one would not discriminate sufficiently. The same reasoning was used for the $400 intervals of salary. To avoid fractions, length of service was taken to the nearest even year.

There were eight beginning mathematics teachers in one of the large cities of Massachusetts who received less than $1,600. These individuals have not been placed in the tables since they are the only ones in their class in Group I.

Men and women for years have been on different levels as far as salary is concerned. In Table II, the men and women have been separated. This table indicates the comparison of women's salaries, men's salaries, and the salaries of both.

Table II A presents the total salary situation. Table II B is a summarized version of Table II A comparing length of service with salary in school Groups I to IV. Table II C compares length of service with salary for all the school groups together. Table II D does the same for preparation and salary. Finally, Table II E is a comparison of length of service with preparation for all the groups together. The reader's attention is next called to all the tables under Table II.

TABLE II A
COMPARISON OF SALARY, EDUCATION AND LENGTH OF SERVICE
PART (1)

		Length of Service in Years															
		0 - 4								5 - 9							
	Sex	M				F				M				F			
	[a]Education Group/	N	B	M	Sub Tot.	N	B	M	Sub Tot.	N	B	M	Sub Tot.	N	B	M	Sub Tot.
	I		7		7		3		3								
$1600-	II		2		2		3		3						1		1
1999	III		3		3		4	1	5						1	1	2
	IV		1		1		6	2	8						1		1
Sub Total			13		13		16	3	19						3	1	4
	I	1	7	1	9		1		1	1	2	2	5	1	1	4	6
2000-	II		8	1	9		4		4		3	2	5		4	2	6
2399	III	1	7		8	1	1		2						2	1	3
	IV		7	2	9		1		1		1	1	2				
Sub Total		2	29	4	35	1	7		8	1	6	5	12	1	7	7	15
S	I		7	2	9		1		1	1	5	8	14		2		2
2400-	II		7	2	9		1		1		6	5	11		1	4	5
2799	III		6		6					1	7	4	12		1		1
A	IV	1	2	2	5						1	3	4			1	1
Sub Total		1	22	6	29		2		2	2	19	20	41		4	5	9
	I		5	3	8					1	9	6	16		1	2	3
L 2800-	II		2		2						3	1	4				
3199	III		1		1						1		1				
	IV										2	1	3				
A Sub Total			8	3	11					1	15	8	24		1	2	3
	I		1		1						2		2		1		1
3200-	II										1		1				
R 3599	III																
	IV										2		2				
Sub Total			1		1						5		5		1		1
Y	I		1		1						1		1				
3600-	II																
3999	III																
	IV																
Sub Total			1		1						1		1				
	I																
4000-	II																
or	III																
over	IV																
Sub Total																	
Total		3	74	13	90	1	25	3	29	4	46	33	83	1	16	15	32

[a] N - No degree, B - Bachelor's Degree, M - Master's Degree.

TABLE II A
COMPARISON OF SALARY, EDUCATION AND LENGTH OF SERVICE
PART (2)

			Length of Service in Years															
			10 - 14								15 - 19							
		Sex	M				F				M				F			
	^a^Education Group/		N	B	M	Sub Tot.	N	B	M	Sub Tot.	N	B	M	Sub Tot.	N	B	M	Sub Tot.
	$1600-1999	I		1		1												
		II						3		3								
		III						2		2								
		IV																
	Sub Total			1		1		5		5								
	2000-2399	I	1	2		3		1		1			1	1		2		2
		II	1		1	2	1	1		2					2	1	1	4
		III			2	2						1	1	2				
		IV														1		1
	Sub Total		2	2	3	7	1	2		3		1	2	3	2	4	1	7
S	2400-2799	I		3	3	6		6	1	7		2	4	6		3	7	10
		II		5		5		1		1		3	3	6			2	2
A		III			1	1						1		1				
		IV		1	2	3												
	Sub Total			9	6	15		7	1	8		6	7	13		3	9	12
L	2800-3199	I		8	19	27		6	3	9		3	12	15		3	5	8
		II		3	3	6			1	1		2	1	3			1	1
		III										1	1	2				
A		IV		1	2	3							1	1				
	Sub Total			12	24	36		6	4	10		6	15	21		3	6	9
R	3200-3599	I		7	8	15		1		1	1	5	4	10		1	3	4
		II		1	2	3							2	2				
		III																
Y		IV		1		1							1	1				
	Sub Total			9	10	19		1		1	1	5	7	13		1	3	4
	3600-3999	I		7	6	13						6	9	15				
		II																
		III											1	1				
		IV																
	Sub Total			7	6	13						6	10	16				
	4000-or over	I										1	3	4				
		II																
		III											1	1				
		IV																
	Sub Total											1	4	5				
	Total		2	40	49	91	1	21	5	27	1	25	45	71	2	11	19	32

---

[a] N - No degree, B - Bachelor's Degree, M - Master's Degree.

TABLE II A
COMPARISON OF SALARY, EDUCATION AND LENGTH OF SERVICE
PART (3)

		Length of Service in Years															
		20 - 24								25 - 29							
	Sex	M				F				M				F			
SALARY	[a]Education Group/	N	B	M	Sub Tot.	N	B	M	Sub Tot.	N	B	M	Sub Tot.	N	B	M	Sub Tot.
$1600-1999	I																
	II						1		1					1	1		2
	III						1		1								
	IV											1	1	1			1
	Sub Total						2		2			1	1	2	1		3
2000-2399	I							1	1		1		1		1		1
	II		1		1		1		1						1		1
	III													1			1
	IV		1		1		1		1								
	Sub Total		2		2		2	1	3		1		1	1	2		3
2400-2799	I		2	5	7		6	6	12						2	3	5
	II		1		1		4	2	6			1	1	1	2	1	4
	III																
	IV		1	1	2			1	1			1	1				
	Sub Total		4	6	10		10	9	19			2	2	1	4	4	9
2800-3199	I		6	7	13		6	9	15	1	3	3	7		8	5	13
	II		4	1	5						2		2		1	2	3
	III			4	4												
	IV		1	1	2							2	2				
	Sub Total		11	13	24		6	9	15	1	5	5	11		9	7	16
3200-3599	I		9	10	19		2	5	7	2	5	2	9		2	5	7
	II		1		1							2	2				
	III			1	1							2	2				
	IV										1		1				
	Sub Total		10	11	21		2	5	7	2	6	6	14		2	5	7
3600-3999	I	1	6	17	24						7	1	8			1	1
	II		1	2	3							2	2				
	III			1	1							1	1				
	IV																
	Sub Total	1	7	20	28						7	4	11			1	1
4000- or over	I		4	6	10						2	11	13				
	II																
	III			1	1												
	IV																
	Sub Total		4	7	11						2	11	13				
	Total	1	38	57	96		22	24	46	3	21	29	53	4	18	17	39

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[a]N - No degree, B - Bachelor's Degree, M - Master's Degree.

TABLE II A
COMPARISON OF SALARY, EDUCATION AND LENGTH OF SERVICE
PART (4)

		Length of Service in Years															
		30 - 34								35 - 39							
	Sex	M				F				M				F			
SALARY	[a]Education Group/	N	B	M	Sub Tot.	N	B	M	Sub Tot.	N	B	M	Sub Tot.	N	B	M	Sub Tot.
$1600-1999	I																
	II																
	III													1			1
	IV																
	Sub Total													1			1
2000-2399	I					1	2		3								
	II																
	III						1		1		1		1				
	IV							1	1					1			1
	Sub Total					1	3	1	5		1		1	1			1
2400-2799	I					1	6	2	9						3		3
	II	1	1		2		1		1						1		1
	III			1	1												
	IV																
	Sub Total	1	1	1	3	1	7	2	10						4		4
2800-3199	I		2	1	3	3	7	4	14		1		1	1	4	1	6
	II																
	III		1		1						2		2				
	IV										1		1				
	Sub Total		3	1	4	3	7	4	14		4		4	1	4	1	6
3200-3599	I		3		3			4	4		2		2		2	2	4
	II										1		1		1		1
	III		1	1	2												
	IV																
	Sub Total		4	1	5			4	4		3		3		3	2	5
3600-3999	I		5	4	9		1		1		3	2	5				
	II			1	1												
	III																
	IV																
	Sub Total		5	5	10		1		1		3	2	5				
4000 or over	I		2	4	6						4	3	7				
	II										1		1				
	III		1		1												
	IV																
	Sub Total		3	4	7						5	3	8				
	Total	1	16	12	29	5	18	11	34		16	5	21	3	11	3	17

[a]N - No degree, B - Bachelor's Degree, M - Master's Degree.

TABLE II A
COMPARISON OF SALARY, EDUCATION AND LENGTH OF SERVICE
PART (5)

		Length of Service in Years 40 or over							
	Sex	M				F			
	[a]Education Group	N	B	M	Sub Tot.	N	B	M	Sub Tot.
SALARY	I								
$1600-	II								
1999	III					1			1
	IV								
	Sub Total					1			1
	I					1			1
2000-	II								
2399	III					3			3
	IV								
	Sub Total					4			4
	I					1	2		3
2400-	II								
2799	III								
	IV						1		1
	Sub Total					1	3		4
	I						1	1	2
2800-	II								
3199	III								
	IV								
	Sub Total						1	1	2
	I						1		1
3200-	II			1	1				
3599	III								
	IV								
	Sub Total			1	1		1		1
	I		5		5				
3600-	II								
3999	III								
	IV								
	Sub Total		5		5				
	I		1		1				
4000	II								
or	III								
over	IV								
	Sub Total		1		1				
	Total		6	1	7	6	5	1	12

[a] N - No degree, B - Bachelor's Degree, M - Master's Degree.

TABLE II B
(SUMMARY OF TABLE II A)
COMPARISON OF SALARY, EDUCATION AND LENGTH OF SERVICE

SALARY	Sex [a]Education Group/	Total by Groups M N	 B	 M	 Sub Tot.	 F N	 B	 M	 Sub Tot.	Entire Total By Groups
$1600-1999	I		8		8		3		3	11
	II		2		2	1	9		10	12
	III		3		3	2	8	2	12	15
	IV		1	1	2	1	7	2	10	12
	Sub Total		14	1	15	4	27	4	35	50
2000-2399	I	3	12	4	19	3	8	5	16	35
	II	1	12	4	17	3	12	3	18	35
	III	1	9	3	13	5	4	1	10	23
	IV		9	3	12	1	3	1	5	17
	Sub Total	5	42	14	61	12	27	10	49	110
2400-2700	I	1	19	22	42	2	31	19	52	94
	II	1	23	11	35	1	11	9	21	56
	III	1	14	6	21		1		1	22
	IV	1	5	9	15		1	2	3	18
	Sub Total	4	61	48	113	3	44	30	77	190
2800-3199	I	2	37	51	90	4	36	30	70	160
	II		16	6	22		1	4	5	27
	III		6	5	11					11
	IV		5	7	12					12
	Sub Total	2	64	69	135	4	37	34	75	210
3200-3599	I	3	34	24	61		10	19	29	90
	II		4	7	11		1		1	12
	III		1	4	5					5
	IV		4	1	5					5
	Sub Total	3	43	36	82		11	19	30	112
3600-3999	I	1	41	39	81		1	1	2	83
	II		1	5	6					6
	III			3	3					3
	IV									
	Sub Total	1	42	47	90		1	1	2	92
4000 or over	I		14	27	41					41
	II		1		1					1
	III		1	2	3					3
	IV									
	Sub Total		16	29	45					45
	Total				541				268	809

[a]N - No degree, B - Bachelor's Degree, M - Master's Degree.

TABLE II C
COMPARISON OF LENGTH OF SERVICE WITH SALARY

		Length of Service																			
		0-4		5-9		10-14		15-19		20-24		25-29		30-34		35-39		40-Over		Sub Total	
Sex		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
SALARY[a]	16	13	19		4	1	5				2	1	3				1		1	15	35
	20	35	8	12	15	7	3	3	7	2	3	1	3		5	1	1		4	61	49
	24	29	2	41	9	15	8	13	12	10	19	2	9	3	10		4		4	113	77
	28	11		24	3	36	10	21	9	24	15	11	16	4	14	4	6		2	135	75
	32	1		5	1	19	1	13	4	21	7	14	7	5	4	3	5	1	1	82	30
	36	1		1		13		16		28		11	1	10	1	5		5		90	2
	40							5		11		13		7		8		1		45	
S Tot		90	29	83	32	91	27	71	32	96	46	53	39	29	34	21	17	7	12	541	268
Total		119		115		118		103		142		92		63		38		19			
Grand Total																				809	

TABLE II D
COMPARISON OF PREPARATION WITH SALARY

Sex	Ed.[b]	Sal.	$1600-1999	2000-2399	2400-2799	2800-3199	3200-3599	3600-3999	4000-Over	Sub Totals
M	N			5	4	2	3	1		15
	B		14	42	61	64	43	42	16	282
	M		1	14	48	69	36	47	29	244
Sub Total			15	61	113	135	82	90	45	541
F	N		4	12	3	4				23
	B		27	27	44	37	11	1		147
	M		4	10	30	34	19	1		98
Sub Total			35	49	77	75	30	2		268
Total			50	110	190	210	112	92	45	
Grand Total										809

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[a] Salaries in hundreds of dollars.

[b] N - No degree, B - Bachelor's Degree, M - Master's Degree.

TABLE II E
COMPARISON OF LENGTH OF SERVICE WITH PREPARATION

	Length of Service																		
	0-4		5-9		10-14		15-19		20-24		25-29		30-34		35-39		40-Over		Sub Totals
Sex	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
Degree[a] N	3	1	4	1	2	1	1	2	1		3	4	1	5		3		6	38
B	74	25	46	16	40	21	25	11	38	22	21	18	16	18	16	11	6	5	429
M	13	3	33	15	49	5	45	19	57	24	29	17	12	11	5	3	1	1	342
S Tot	90	29	83	32	91	27	71	32	96	46	53	39	29	34	21	17	7	12	
Total	119		115		118		103		142		92		63		38		19		
Grand Total																			809

[a]N - No degree, B - Bachelor's Degree, M - Master's Degree.

Observations. Since some of the information is repeated in several parts of the tables, the salaries, academic preparation, and length of service of mathematics teachers are discussed in the section where they are most readily understood.

In Table II A, "Comparison of Salary, Education, and Length of Service," and in the summary version, II B, the following facts were noted:

1. The highest paid man in the zero to four year service group with only a bachelor's degree was receiving more than the highest paid woman in the over forty year group with only a bachelor's degree.
2. About two-thirds of the mathematics teachers were men.
3. All four groups of schools had about the same number of teachers in the $1,600-$1,999 salary groups.
4. In the column labeled "Final total by groups," it was noted that the proportion of the number of teachers in

FIGURE I
THE NUMBER OF MATHEMATICS TEACHERS IN THE SALARY RANGES

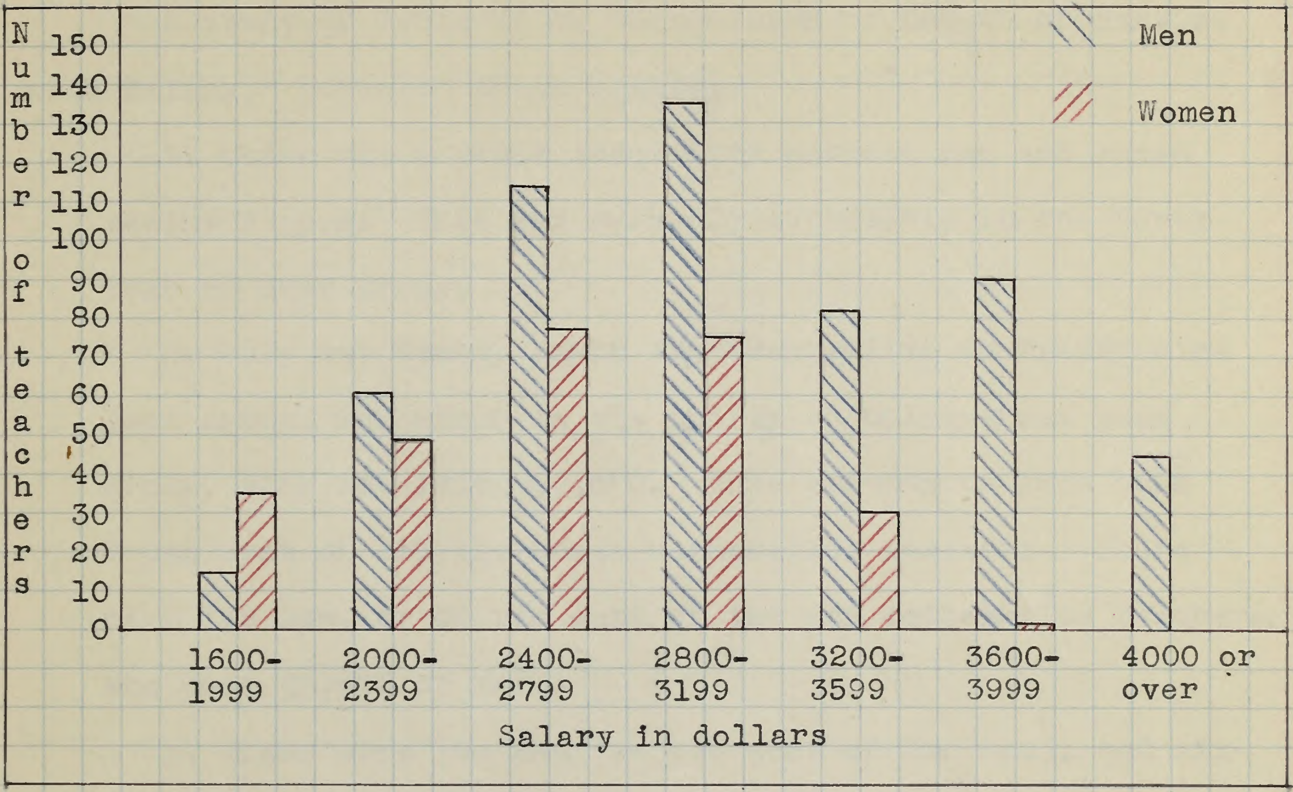
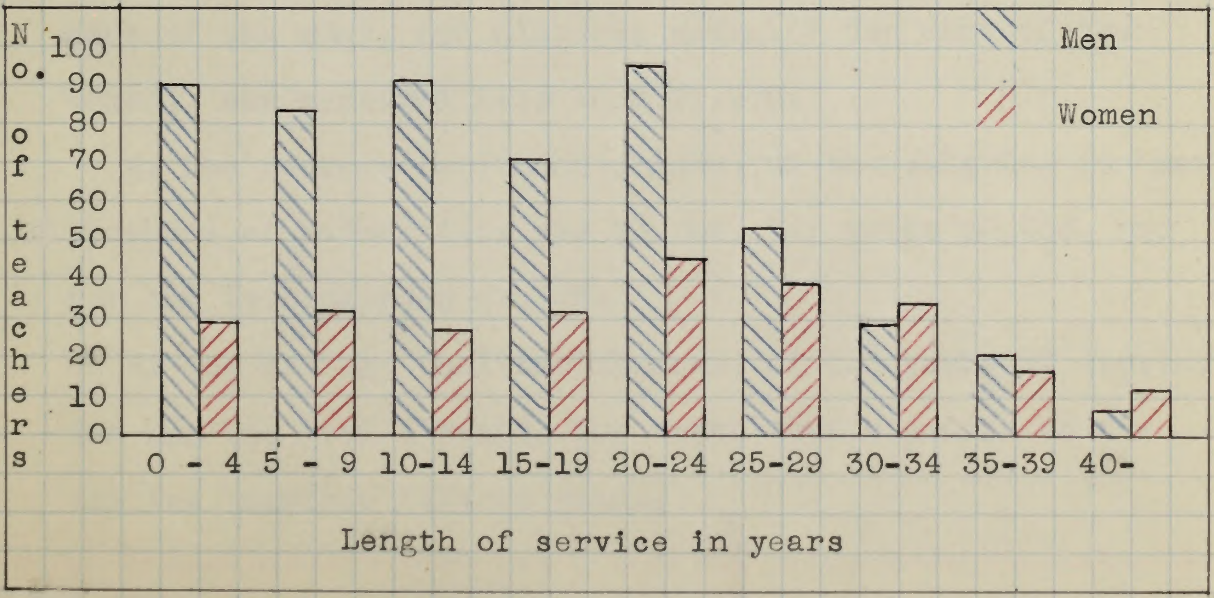


FIGURE II
THE NUMBER OF MATHEMATICS TEACHERS AND THEIR LENGTH OF SERVICE



Group I to the other groups increased with the increase of salary.

A study of Table II C, "Comparison of Length of Service with Salary," revealed these points:

1. There was a great inequality between men and women teachers' pay. This was markedly noticeable in the forty year or over group.

2. Only two women, one in the twenty-five to twenty-nine year group, the other in the thirty to thirty-four year group, were receiving $3,600. This amounts to less than 1 per cent of all the women mathematics teachers. There were 135 men, or 25 per cent of the men mathematics teachers, who made $3,600 or more.

3. There were two men, (.4 per cent of the men), and sixteen women, (6 per cent of the women), with service of ten years or longer who received less than $2,000. In the zero to four year service group, including the eight men who received less than $1,600, there were twenty-one men, (4 per cent of the men), and nineteen women, (7 per cent of the women), who received less than $2,000.

4. The average (arithmetic mean) of the salaries for men teachers of mathematics was $3,086, for women $2,633, and for the two together $2,936.

5. The average (arithmetic mean) of the years of service for men was twelve years, for women twenty years and for the two together fifteen years.

In Table II D, "Comparison of Preparation with Salary," the following points were noted:

1. A greater number of men in salary groups $2,800-$3,199, $3,600-$3,999, and $4,000 and over had a master's degree than a bachelor's degree alone.

2. Women with no degree had no salary above $3,200.

3. The number of men teachers with no degree was almost a descending arithmetic progression beginning with the $2,000-$2,399 group.

4. There was a great increase in the number with a master's degree through the salary groups up to the $2,800-$3,199 group.

The following observations were made on Table II E, "Comparison of Length of Service with Preparation":

1. There were more women in the forty year group with no degree than in any other.

2. In the service groups ten to twenty-nine there were more men mathematics teachers with a master's degree than with only a bachelor's degree. The same was true for the women in groups fifteen to twenty-four.

3. Of the total mathematics teacher population, 5 per cent had no degree, 53 per cent had only a bachelor's degree, and 42 per cent had a master's degree.

4. Of all the men mathematics teachers there were 2.8 per cent with no degree, 52.2 per cent with only a bachelor's degree, and 45 per cent with a master's degree. Of all

the women mathematics teachers there were 8.6 per cent with no degree, 54.8 per cent with only a bachelor's degree, and 36.6 per cent with a master's degree.

Since many facts are hidden in a mass of figures, two bar graphs were made to show (1) the number of teachers in each length of service group and (2) the number of teachers in each salary range.

In Figure I, "The Number of Teachers in the Salary Ranges," the following items were noted:

1. Statistically, the distribution of the number of teachers in the salary ranges was nearly normal.

2. In the first years of teaching, there were many more men than women. The proportion of women teachers gradually increased until after thirty years' teaching there were slightly more women than men.

3. There were more mathematics teachers in the $2,800-$3,199 salary range than any other.

From Figure II, "The Number of Teachers and Their Length of Service," the following was observed:

1. The length of service groups of the men remained fairly constant up to the twenty to twenty-five year group.

2. The women's service groups remained fairly constant up to the thirty to thirty-four year group.

3. This figure shows more dramatically how the number of men and women approaches equality after twenty-five years of service.

III. TEACHING COMBINATIONS WITH MATHEMATICS

Preliminary statement. Frequently teachers of mathematics, in addition to mathematics, are required to teach one or more other subjects. There are at least two advantages to this situation: (1) it gains more effective correlation of related subjects and (2) it allows the teachers to teach those subjects for which they have the background, ability, and desire. For obvious reasons more teaching combinations should occur in the smaller school where classes are not large enough to demand a separate teacher for each subject.

The following quotation from The Mathematics Teacher further discusses this aspect:

> Most of the studies reported concerned all of the teachers in the state although a few of them covered beginning teachers only. It is likely, however, that a large percentage of the beginning teachers will be found teaching other subjects with mathematics than is reported in these studies since the general tendency is for the more experienced teacher to get into the city schools in which single teaching subjects are common.[5]

Paul Tully and John Fraden[6] suggest that teaching combinations of mathematics and science are the most effective way for teachers to learn ways in which the two subjects are related and to benefit from each others' problems.

The teaching of mathematics with science was encouraged

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[5] Anderson, E. W., and Eliasson, R. H., "High School Mathematics Teachers in the United States," The Mathematics Teacher, 24:412, November, 1931.

[6] Tully, P., and Fraden, J., "Correlation of Mathematics with Science," California Journal of Secondary Education, 15:352, October, 1940.

by Breslich so that the teacher will not become too "one sided or too highly specialized."[7] The following statement in the *Fifteenth Yearbook of The National Council of Mathematics Teachers* carried this a bit further including the cultural value:

> There are many mathematics teachers who have preferred foreign language, frequently Latin, as a minor, and others who have been drawn towards English, or toward history. The commission regards such combinations as having much merit, and would not discourage them. However correct may be the assertion that language study does not employ mathematics, the question involved is not disposed of by so obvious an assertion. Many investigations have shown a striking correlation between grades in mathematics and grades in foreign language. Both studies are definitely intellectual, with a good, firm texture unalloyed by the trivial and commonplace; and it is not strange that some persons should desire to teach two subjects that spring from congenial impulses.[8]

Anderson and Eliasson[9] made a study in 1931 of the teaching combinations of mathematics teachers in twenty-three states. Massachusetts was not included in the study. The per cents refer to the per cent of the total number of combinations. The order in which the teaching combinations appeared were math-science (45%), math-social studies (27%), math-physical education (9.6%), math-English (7.7%), math-Latin (6.1%), math-commercial (2.3%), math-music (1.1%), and math-agriculture (1.1%).

The interesting fact that several administrators taught mathematics along with their administrative duties gave rise to Table IV.

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[7] Breslich, E. R., *The Administration of Mathematics in Secondary Schools* (Chicago, Illinois: University of Chicago Press, 1933), p. 11.

[8] "The Place of Mathematics in Secondary Education," *Fifteenth Yearbook of The National Council of Teachers of Mathematics* (New York: Bureau of Publications, Teachers College, Columbia University, 1940), pp. 197, 198.

[9] Anderson, E. W., and Eliasson, R. H., *loc. cit.*

TABLE III

TEACHING COMBINATIONS OF ALL MATHEMATICS TEACHERS

Subjects[a]	Group I		II		III		IV		Totals		
Sex	M	F	M	F	M	F	M	F	M	F	Both
M	246	133	46	31	14	9	4		310	173	483
M,S	48	9	25	2	21	8	28	1	122	20	142
M,H	17	7	8	6	5	1	5	3	35	17	52
M,E	4	7	3	6	1			2	8	15	23
M,C	7	6	1	2	2		1	1	11	9	20
M,MF	6	4	1	2					7	6	13
M,AF	2	3	1	2				1	3	6	9
M,S,IA	3				3		2	1	8	1	9
M,H,E		1		1		2	2	3	2	7	9
M,S,C	2	1			1	2			3	3	6
M,S,H	1		2		3				6		6
M,S,E	1	1				1	1	2	2	4	6
M,IA	3	1	2						5	1	6
M,PE	1		2	1	2				5	1	6
M,S,PE			1		1		1	1	3	1	4
M,H,MF		1		1	1			1	1	3	4
M,H,AF			1		1		1		3		3
M,E,AF	1			1	1				2	1	3
M,S,MF	1						1		2		2
M,S,H,AF	1	1							1	1	2
M,S,H,E		1								1	1
M,S,H,C					1				1		1
M,S,H,PE					1				1		1
M,H,MF,AF						1				1	1
M,C,MF,AF								1		1	1
M,S,AF,PE							1		1		1
M,MF,MUS		1								1	1
M,H,C	1								1		1
M,E,C				1						1	1
Sub Totals	345	177	93	56	58	24	47	17	543	274	
Totals	522		149		82		64				817

[a] M - Mathematics, S - Science, H - History and other Social Studies, E - English, C - Commercial Subjects, MF - Modern Foreign Language, AF - Ancient Foreign Language, IA - Industrial Arts, PE - Physical Education, Mus - Music.

TABLE IV
PRINCIPALS AND VICE-PRINCIPALS AND THEIR TEACHING COMBINATIONS INVOLVING MATHEMATICS

	GROUP										
	I		II		III		IV		Totals		
Position[a]	P	VP	P	VP	P	VP	P	VP	P	VP	Both
Combination[b]											
M	4	11	14	4	13		3	1	34	16	50
M,S		1	1		2	1	18	2	21	4	25
M,H				1	1		3		4	1	5
M,E		1		1	1				1	2	3
M,IA		1								1	1
M,PE				1						1	1
M,H,S					1				1		1
M,H,S,C						1				1	1
M,E,S							1		1		1
M,H,E								1		1	1
M,MF							1		1		1
Totals	4	14	15	7	18	2	26	4	63	27	90

[a] P - Principal, VP - Vice-Principal or Ass't Principal

[b] See Table III

Tabulation. All the full time teachers were included in Table III and IV. The teaching combinations were arranged from the largest at the top of the table to the smallest at the bottom. Men and women were separated in Table III so that the difference in teaching combinations by sexes could be noted. The key to the subjects was taken from the original survey with the exception of physical education and music.

In Table IV on principals and vice-principals, the men and women were not separated since there were only three women in these administrative positions.

Observations. In Table III, "Teaching Combinations of All Mathematics Teachers," the following information has been

given:

1. There were twenty-eight teaching combinations with mathematics.

2. The first five dual combinations covered the fields of science, social studies, English, commercial subjects, and foreign languages.

3. In the combination of mathematics and English there were nearly twice as many women as men.

4. The per cent of the total for each school group that taught mathematics alone was 73 per cent for Group I, 52 per cent for Group II, 28 per cent for Group III, and 12 per cent for Group IV.

5. Mathematics teachers who taught mathematics alone composed 59 per cent of the mathematics teaching population. Of the remaining 41 per cent, nearly 22 per cent had a teaching combination containing mathematics and science.

6. In population Groups III and IV, representing the smaller schools, there were many more men who taught mathematics and science than just mathematics. The ratio of the number of mathematics and science teachers to mathematics teachers was as three is to two in Group III and as seven is to one in Group IV.

7. There were seven combinations of four different courses.

Table IV, "Principals and Vice-Principals and Their Teaching Combinations Involving Mathematics," showed the following facts:

1. Two thirds of the principals and vice-principals who taught mathematics in Group IV taught a mathematics-science combination.

2. A little under 25 per cent of the schools in the survey had a principal who taught mathematics or some combination which included it.

3. As might be expected in the larger high schools, there were fewer principals and more vice-principals who taught mathematics than in any other group.

4. The greatest number of principals and vice-principals teaching mathematics taught combinations of mathematics with science, history, and English in that order.

5. The ratio of the principals to the vice-principals among those who taught some mathematics was more than two to one.

IV. TEACHING LOAD OF THE MATHEMATICS TEACHER

Preliminary statement. The topics under observation in this section are the characteristics of the teaching schedule and classes of the mathematics teacher. Although the teachers may have a six hour teaching day, to which they have no reason to object, they have in addition the actual preparation. This makes teaching more difficult than positions with no outside preparation. The short actual teaching day is easily offset by preparation and work necessary after hours.

Furthermore, the larger number of different classes the teacher has makes the preparation increasingly arduous. Teach-

ers in smaller schools, who often have four or five different courses to teach, will necessarily spend more time on outside planning than those teachers in larger schools who teach two or three of the same courses requiring similar preparation.

Teachers in the smaller schools, however, have the advantage of smaller classes and more opportunity to know and understand each pupil. This is one of the rich rewards of teaching which is more difficult to attain with the over-sized classes of some of the large schools.

Tabulation. All the tables on the teaching load were frequency distributions. The sub-intervals in Tables V, VIII, and IX were determined by a division of the ranges such that the frequencies would not be too widely scattered or too densely grouped. To compare the men and women, the material was separated into male (M) and female (F).

In Tables V, VI, and IX where there were less than the 817 full time mathematics teachers, this was due to omissions on the questionnaire. For the same reason the number of periods in Table VIII was less than Table VII.

Observations. The following facts were noted in Table V, "Number of Teaching Periods Per Week of the Mathematics Teacher":

1. The average (arithmetic mean) of the teaching periods per week of mathematics teachers was twenty-one periods for men, twenty-two periods for women, and twenty-one for both men and women.

TABLE V
NUMBER OF TEACHING PERIODS PER WEEK OF THE MATHEMATICS TEACHER

Periods		Number in Group														
		I			II			III			IV			Total		
	Sex	M	F	Sub Tot.	M	F	Sub Tot.	M	F	Sub Tot.	M	F	Sub Tot.	M	F	Both
1-5		5		5	10	2	12	3		3	1		1	19	2	21
6-10		8	2	10	7		7	8		8	3		3	26	2	28
11-15		14	6	20	1	1	2	7	1	8	6		6	28	8	36
16-20		86	42	128	16	5	21	11	2	13	12		12	125	49	174
21-25		208	113	321	40	33	73	17	15	32	14	12	26	279	173	452
26-30		21	13	34	19	14	33	9	5	14	11	5	16	60	37	97
31-35		3		3		1	1	3	1	4				6	2	8
36-39			1	1											1	1
Sub Totals		345	177	522	93	56	149	58	24	82	47	17	64	543	274	817

TABLE VI
NUMBER OF CLASSES PER DAY OF THE MATHEMATICS TEACHER

Number of Classes		Number in Group														
		I			II			III			IV			Total		
	Sex	M	F	Sub Tot.	M	F	Sub Tot.	M	F	Sub Tot.	M	F	Sub Tot.	M	F	Both
1		8	1	9	9	2	11	2		2				19	3	22
2		7	5	12	8		8	6		6	3		3	24	5	29
3		17	3	20	6	1	7	9		9	5		5	37	4	41
4		75	20	95	12	4	16	4	3	7	14	1	15	105	28	133
5		197	123	320	41	31	72	23	12	35	17	9	26	278	175	453
6		26	19	45	16	14	30	10	9	19	7	5	12	59	47	106
7		9	4	13		2	2	3		3		1	1	12	7	19
8		5		5		2	2							5	2	7
9		1	1	2	1		1							2	1	3
Sub Totals		345	176	521	93	56	149	57	24	81	46	16	62	541	272	813

TABLE VII
NUMBER OF THE MATHEMATICS TEACHER'S CLASSES OF MORE THAN THIRTY

Classes of more than thirty		Number in Group														
		I			II			III			IV			Total		
	Sex	M	F	Sub Tot.	M	F	Sub Tot.	M	F	Sub Tot.	M	F	Sub Tot.	M	F	Both
1		87	33	120	20	6	26	8	5	13	2	2	4	117	46	163
2		52	33	85	14	11	25	2	1	3	2		2	70	45	115
3		38	14	52	3	7	10	2		2				43	21	64
4		23	10	33										23	10	33
5		12	5	17	1	1	2		1	1				13	7	20
6			1	1					2	2					3	3
7			1	1		1	1								2	2
8		1		1										1		1
Sub Totals		213	97	310	38	26	64	12	9	21	4	2	6	267	134	401

TABLE VIII
NUMBER OF PUPILS IN THE MATHEMATICS TEACHER'S LARGEST CLASS OVER THIRTY

Size of largest class		Number in Group														
		I			II			III			IV			Total		
	Sex	M	F	Sub Tot.	M	F	Sub Tot.	M	F	Sub Tot.	M	F	Sub Tot.	M	F	Both
30-34		103	53	156	19	11	30	4	5	9	1	1	2	127	70	197
35-39		88	33	121	14	9	23	5	2	7	1		1	109	43	152
40-44		20	9	29	3	3	6	3	1	4	1		1	27	13	40
45-49		1		1		1	1		1	1				1	2	3
50-54												1	1		1	1
55-59		1		1										1		1
Sub Totals		213	95	308	36	24	60	12	9	21	3	2	5	265	129	394

TABLE IX
NUMBER OF PUPILS OF EACH MATHEMATICS TEACHER

Number of pupils	Number in Group															
	I				II			III			IV			Total		
	Sex	M	F	Sub Tot.	M	F	Sub Tot.	M	F	Sub Tot.	M	F	Sub Tot.	M	F	Both
0-19		1		1	6		6	1		1	2		2	10		10
20-39		7	3	10	6	2	8	5		5	9	1	10	27	6	33
40-59		3	1	4	3	1	4	5	1	6	18	3	21	29	6	35
60-79		17	6	23	8	2	10	11	3	14	9	5	14	45	16	61
80-99		31	10	41	15	12	27	14	7	21	2	4	6	62	33	95
100-119		74	43	117	21	13	34	10	5	15	2	3	5	107	64	171
120-139		100	51	151	22	13	35	8	1	9	1		1	131	65	196
140-159		66	38	104	7	11	18	1	2	3		1	1	74	52	126
160-179		28	13	41	2	1	3	2	1	3				32	15	47
180-199		10	7	17	1	1	2							11	8	19
200-219		6	5	11	2		2		1	1				8	6	14
Sub Totals		343	177	520	93	56	149	57	21	78	43	17	60	536	271	807

2. The range of the number of teaching periods per week is from one to thirty-nine.

In Table VI, "Number of Classes Per Day of the Mathematics Teacher," these points were observed:

1. The arithmetic mean for the men, women and both together was five classes per day.
2. The number of classes per day ranged from one to nine.

In Table VII, "Number of the Mathematics Teacher's Classes of More Than Thirty," these facts were noted:

1. Of all the mathematics teachers' classes, 22 per cent had more than thirty pupils.
2. The per cent of the total number of classes with thirty or more pupils was for Group I 77 per cent, Group II 16 per cent, Group III 5 per cent, and Group IV 2 per cent.
3. One unfortunate male teacher in Group I had eight classes with thirty or more pupils.

The following information was noted in Table VIII, "Number of Pupils in the Mathematics Teacher's Largest Class over Thirty":

1. Of the largest classes with over thirty pupils 89 per cent were in the intervals thirty to thirty-four and thirty-five to thirty-nine.
2. One male teacher in Group I had a class in the fifty-five to fifty-nine pupil interval.

From Table IX, "Number of Pupils of Each Mathematics

Teacher," these facts were learned:

1. Of the total number of mathematics teachers the arithmetic average of the number of pupils per teacher was 112 pupils for men, 122 pupils for women, and 116 pupils for both.

2. About 1.7 per cent of all the mathematics teachers had a total of 200 or more pupils.

This chapter has presented the data on the mathematics teacher. First, Tables II A, II B, II C, II D, and II E, dealing with the comparison of salaries, length of service, and preparation have been observed. Next, Table III on teaching combinations of all teachers, and Table IV on teaching combinations of principals and vice-principals, have been compiled and observed. Finally, Tables V, VI, VII, VIII, and IX on the size and number of the mathematics teacher's classes have been examined for significant facts.

CHAPTER III

THE STATUS OF THE MATHEMATICS OFFERED THE STUDENT

I. THE PURPOSE

Problem. A subject can be taught in informal clubs as well as in the formal classroom. The problem of this chapter was to present the reader with a detailed description of both these forms of teaching in the field of mathematics within the limits of this survey.

Material used. The data used in the chapter were obtained from the original survey by means of forms similar to that appearing as Appendix B in this thesis. From the material on these forms the tables were determined and compiled. The reason for the omission of any of the material mentioned in Appendix B is to be taken up later in the chapter.

Points to be covered. The first topic to be taken up is the number and type of school mathematical organizations that existed in Massachusetts public high schools. The other topic is the mathematics courses which were given in these schools. Under this are to be found the number of schools which offered the different mathematics courses, when they were offered, and the per cent of the school population in them. Following this, the distribution of the mathematics course selections is to be considered.

II. PUPIL MATHEMATICS ORGANIZATIONS

Preliminary statement. Many articles have been written to stimulate interest in mathematical organizations. Plays have been written and mathematical tricks have been devised. Every effort has been made to make the organizations attractive. Whether these organizations are popular or not is to be shown in Table X.

Gertrude E. Allen, in the Second Yearbook of the National Council of Teachers of Mathematics, said that mathematics clubs "provide a worthy medium for self expression for gifted students and inspire them with higher ideals for continued effort."[1]

Tabulation. The difficulty in tabulating the data on mathematical organizations was to create a postage stamp small enough to make the figures noticeable. Information for Table X came from only thirteen high schools of Group I, which is five per cent of all the high schools in the state. None of the schools gave credit for mathematical organization work, so no provision has been made for this. The table follows.

TABLE X
PUPIL MATHEMATICS ORGANIZATIONS

Name	Number in group I[a]
Mathematics Club	9
Slide Rule Club	2
Aeronautics Club	1
Navigation Club	1
Math Laboratory Staff	1
Pythagorean Club	1
Total	15

[a] None in Groups II, III, IV.

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[1] Allen, G. E., "A Reorganized Course of Study for Senior High School Mathematics," Second Yearbook of The National Council of Teachers of Mathematics (New York: Bureau of Publications, Teachers College, Columbia University, 1927), p. 287.

Since the attendance was not mandatory, the figures on attendance are estimates which are not significant enough to be included.

Observations. Not too much can be noted from the meager details available in Table X. However, with this information the following is to be noted:

1. In the 258 high schools of Massachusetts only fifteen mathematics organizations in thirteen schools were reported.
2. The most popular name for the club was the obvious, Mathematics Club, of which there were nine. Next came the Slide Rule Club, of which there were two.

III. COURSES OFFERED

Preliminary statement. There have been many suggestions offered as to ways of reorganizing mathematics to make it more useful and valuable. In 1940 Betz stated that at a meeting of the National Council of Mathematics in St. Louis, it was declared that the situation was one characterized by "a nationwide battle between brief, specialized courses in 'social mathematics,' 'consumer's mathematics,' 'vocational mathematics,' etc., and a more broadly conceived program of 'cultural mathematics'."[2] This controversy has affected the number of courses of each type which are offered.

The tables to be given show the status of Massachusetts

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[2] Betz, W., "The Present Situation in Secondary Mathematics, with Particular Reference to the New National Reports on the Placement of Mathematics in Education," The Mathematics Teacher, 33:340, 1940.

with regard to the courses the schools had to offer.

A great deal has been said in the literature about the grade placement of mathematics. The Fourteenth Yearbook[3] gave the traditional order of grade placement of algebra in the ninth, plane geometry in the tenth, and solid geometry, intermediate algebra, advanced algebra, and trigonometry in the eleventh and twelfth grades. These courses were said to lack continuity because they were elective and taught in isolated units. In his article, "Some Considerations Appertaining to the Content of High School Mathematics,"[4] Mirick gave two common plans of grade placement which have plane geometry and intermediate algebra in either the tenth or eleventh grade. He had four objections to both arrangements. First, the subjects were taught independent of each other. Second, too much time elapsed between the time a pupil took a course and when he needed the information next. Third, the rigidity of the course stifled teacher initiative. And last, courses end without giving a view of mathematics as a whole. Mirick believed that teachers should not be limited by a set group of courses but should be allowed to develop mathematics courses along the lines of continuity.

Whether the **traditional** or a continuous type course is

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[3] "Training of Mathematics Teachers," _Fourteenth Yearbook of The National Council of Teachers of Mathematics_ (New York: Bureau of Publications, Teachers College, Columbia University, 1939), pp. 73, 74.

[4] Mirick, G, R., "Some Considerations Appertaining to the Content of High School Mathematics," _The Mathematics Teacher_, 27:41, 42, January, 1934.

offered in Massachusetts is to be discovered in the table dealing with grade placement. Before leaving the topic of grade placement, it might be profitable to see what Wrinkle has to say about it.

> There is little scientific justification for the grade placement of mathematics in the conventional program of studies. It is interesting that algebra and geometry with rare exceptions are placed in grades nine and ten of the conventional high school program. Why algebra should be in the ninth grade and geometry in the tenth grade is an interesting question for speculation. Apparently the justification for this placement goes back to the time when high schools commonly taught four years of mathematics because four units of mathematics were required for college entrance. In order to make possible the four year program, the first course had to be placed in the ninth grade. Today schools offering four years in mathematics, or even three years in the senior high school, are a relatively small proportion of the total number of high schools.[5]

Wrinkle[6] followed this statement a little later by the suggestion that mathematics should be pushed into the upper grades as far as possible, especially if a school offered only two years of mathematics. This cannot be checked too easily in this study since very few schools offered only two years of mathematics.

All the literature agrees that reorganization of mathematics courses is necessary, but there are many different suggestions as to how it should be carried out. The situation of mathematics courses in Massachusetts is now to be determined.

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[5] Wrinkle, W. L., "Mathematics in the Modern Curriculum for Secondary Education," The Mathematics Teacher, 29:376, 1936.

[6] Ibid., p. 379, 380.

Tabulation. The courses named in Tables XI, XII, and XIII represent courses mentioned in the survey under similar names - for example, under vocational mathematics would come vocational algebra, under technical mathematics would come technical geometry. When the courses in the survey did not closely suggest the names of the courses in Tables XI and XIII, they were collected under the title "Others." When they appeared in the making of Table XII, they were omitted as not being significant enough to be included. Under this name "Others" were included the subjects war mathematics, pre-induction mathematics, beta-mathematics, gamma mathematics, nurses' mathematics, nurses' arithmetic, college mathematics, intermediate mathematics, everyday mathematics, senior mathematics, navigation, aerial navigation, slide rule, surveying, principles of strength of materials, and architectual drawing. Each of these courses was offered in less than three of the public high schools of Massachusetts.

The courses in Tables XI, XII, and XIII have been placed in order from the greatest number of schools to the smallest number of schools that offered them. Courses which were offered for only a fractional part of a year were considered as one course. None of these fractional parts was less than one third. They appeared most frequently in the courses review mathematics, solid geometry, and trigonometry.

In Tables XI, XII, XIII, and XIV the schools were classified into two types, those which could offer mathematics for

four years and those which could offer it for three years. This classification was felt necessary since more courses could be offered in the four year high school. Only one school in group III and one school in group IV were three year high schools.

Two schools were not included in these tables because they had not filled out the section in this part of the survey questionnaire. Three more schools did not show when the courses were offered and were therefore omitted from Table XII.

At the foot of Table XII a key has been given to explain the abbreviated titles of courses. Definitions of the courses which would add to the reader's common knowledge cannot be made since the content of the courses named has not been listed.

The distribution of mathematics courses in Table XIV was based on a typical course of first year algebra, plane geometry, algebra I, and solid geometry and/or trigonometry. Deviations from this selection were in terms of specialized mathematics, general mathematics, review mathematics, some other course, programs with less than the typical selection but with more than one other course. Then the programs with more than the typical selection were numbered up to more than four other courses in the selection.

To generalize Table XIV, a consolidation of the courses offered was made. Advanced algebra and algebra-geometry were considered under Algebra II. Technical, vocational, shop, war, and nurses' mathematics were considered a part of specialized

TABLE XI
NUMBER OF SCHOOLS OFFERING THE DIFFERENT MATHEMATICS COURSES

Course	Type of school[a]	Number of schools in Group				Sub	
		I	II	III	IV	Total	Total
Algebra I	4	62	51	50	43	206	
	3	31	3			34	240
Plane Geometry	4	61	49	48	35	193	
	3	34	9	1	1	45	238
Algebra II	4	57	45	35	27	164	
	3	30	7	1	1	39	203
Solid Geometry & Trigonometry	4	50	38	19	7	114	
	3	25	8	1		34	148
Review Math.	4	26	13	20	14	73	
	3	16	4		1	21	94
General Math.	4	21	16	9	12	58	
	3	3	2			5	63
Shop Math.	4	14	6	4	1	25	
	3	11	2			13	38
Trigonometry	4	6	5	7	4	22	
	3	5	1			6	28
Practical Math.	4	10	4	3		17	
	3	4				4	21
Solid Geometry	4	6	2	5	2	15	
	3	2	1			3	18
Advanced Math	4	4	2		1	7	
	3	1				1	8
Basic Math.	4	3	3			6	
	3		1			1	7
Vocational Math.	4	4				4	
	3	2				2	6
Related Math.	4	2	2			4	
	3	1				1	5
Arithmetic	4	1				1	
	3	1	2			3	4
Consumers Math.	4	2		1		3	
	3	1				1	4
Technical Math.	4	3				3	
	3	1				1	4
Algebra-Geometry	4	1				1	
	3	2				2	3
Others	4	9	4	1		14	
	3	5	3			8	22
Total		517	283	205	149		1154

[a] Type of School refers to the four and three year high schools

TABLE XII
WHEN MATHEMATICS COURSES ARE OFFERED

Course[b]	Type[a]	Group I Grade 9	10	11	12	Group II Grade 9	10	11	12	Group III Grade 9	10	11	12	Group IV Grade 9	10	11	12	Total Grade 9	10	11	12
Al I	4	61	8	5	5	48	2			48	2			44	6	1		201	18	6	5
	3	x	32	6	2	x	3			x				x				x	35	6	2
Pl Geo	4	3	49	18	5		43	12	1	1	41	13	1	2	40	8	1	6	173	51	8
	3	x	26	14	3	x	8	1		x	1			x				x	35	15	3
Al II	4	1	11	39	16	1	9	35	5		7	31	14		7	33	17	2	34	138	52
	3	x	9	32	11	x	1	7	2	x		1		x				x	10	40	13
S & T	4			2	44			5	44			7	26			9	19			23	133
	3	x		1	27	x			6	x			1	x				x		1	34
Rev M	4		1	10	19	1	1	7	10	1	2	5	11	1	1	7	9	3	5	29	49
	3	x		5	11	x		2	3	x				x				x		7	14
Gen M	4	18	6	4	3	16	4	1		7	2	1		10	5			51	17	6	3
	3	x	2	1	1	x	1	1		x				x				x	3	2	1
Shop M	4	9	11	6	7	1	2	3	3	1	3	1	1			1	1	11	16	11	12
	3	x	8	8	8	x	1	3	1	x				x				x	9	11	9
Trig	4				10			1	5			1	3			2	3			4	21
	3	x		3	5	x		1		x				x				x		4	5
Pra M	4	2	4	2	2	2	1	1	2	2	1							6	6	3	4
	3	x	4	2	3	x				x				x				x	4	2	3
S Geo	4		1	3	8				1			1	2				2		1	4	13
	3	x			3	x			1	x				x				x			4
Adv M	4				5			1	2								1			1	8
	3	x			2	x				x				x				x			2
Bas M	4		2		1	1	1		2				1					1	3		4
	3	x				x	1	1		x	1	1	1	x				x	2	2	1
Voc M	4			2	1															2	1
	3	x	1	2	1	x				x				x				x	1	2	1
Rel M	4	1	2	3	3	1												2	2	3	3
	3	x	1	1	1	x				x				x				x	1	1	1
Arith	4	1										1	1					1		1	1
	3	x	1			x			1	x				x				x	1		1
Con M	4		2	1	1					1								1	2	1	1
	3	x	1	1		x				x				x				x	1	1	
Tec M	4		2	2	2														2	2	2
	3	x			1	x				x				x				x			1
Al-Geo	4			1																1	
	3	x	2	3	1	x				x				x				x	2	3	1
Total		96	186	177	212	71	78	82	89	61	60	63	62	57	59	61	53	285	383	383	416

[a] Type refers to the four and three year high schools

[b] Al - Algebra, Pl Geo - Plane Geometry, Rev M - Review Math., S Geo - Solid Geometry, Trig.- Trigonometry, Gen M - General Math., Pra M - Practical Math., S & T - Solid Geometry and Trigonometry, Tec M - Technical Math., Adv M - Advanced Math,, Arith - Arithmetic, Al-Geo - Algebra-Geometry, Con M - Consumer's Math,, Rel M - Related Math., Voc M - Vocational Math., Bas M - Basic Math., Shop M - Shop Math..

Note! x indicates no ninth grade in three year high school

TABLE XIII A
GROUP TOTALS OF SCHOOL POPULATION AND NUMBER OF PUPILS IN EACH MATHEMATICS COURSE

	Type of[a] school	Group I	II	III	IV
Population	4	69415	16901	7371	2989
	3	40436	3257	102	90
Sub total		109851	20158	7473	3079

Course	Type[a] of school	Mathematics population Group I	II	III	IV
Algebra I	4	9794	2484	1198	622
	3	1895	95		
Plane Geometry	4	8807	1787	828	345
	3	5294	730	12	16
Algebra II	4	6096	1348	494	220
	3	4329	497	11	14
Solid Geometry & Trigonometry	4	1812	408	171	40
	3	930	146	5	
Review Math.	4	1564	231	233	101
	3	948	135		5
General Math.	4	2109	587	190	165
	3	161	84		
Shop Math.	4	1203	103	38	5
	3	990	58		
Trigonometry	4	196	52	62	10
	3	497	33		
Practical Math.	4	573	122	65	
	3	314			
Solid Geometry	4	294	6	25	3
	3	53	9		
Advanced Math.	4	64	38		8
	3	70			
Basic Math.	4	107	75		
	3		140		
Vocational Math.	4	99			
	3	54			
Related Math.	4	225	30		
	3	208			
Arithmetic	4	57			
	3	25	15		
Consumer's Math.	4	63		24	
	3	52			
Technical Math.	4	316			
	3	24			
Algebra-Geometry	4	51			
	3	379			
Others	4	880	89	10	
	3	749	67		
Sub Total in	4	34310	7360	3338	1519
Sub Total in	3	16972	2009	28	35
Sub Total		51282	9369	3366	1554

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[a] Type of school refers to the four and three year high schools.

TABLE XIII B
(TOTALS DERIVED FROM TABLE XIII A)
TOTAL NUMBER OF PUPILS AND PER CENT OF HIGH SCHOOL POPULATION IN EACH MATHEMATICS COURSE

	Type of[a] school	
Population in	4	96676
Population in	3	43885
Total High School population		140561

Course	Type of school[a]	Sub total math population	Total math population	% of total H S population
Algebra I	4	14098	16088	11.45
	3	1990		
Plane Geometry	4	11767	17819	12.69
	3	6052		
Algebra II	4	8158	13009	9.26
	3	4851		
Solid Geometry & Trigonometry	4	2431	3512	2.49
	3	1081		
Review Math.	4	2129	3217	2.29
	3	1088		
General Math.	4	3051	3296	2.34
	3	245		
Shop Math.	4	1349	2397	1.70
	3	1048		
Trigonometry	4	320	850	0.60
	3	530		
Practical Math.	4	760	1074	0.76
	3	314		
Solid Geometry	4	328	390	0.28
	3	62		
Advanced Math.	4	110	180	0.13
	3	70		
Basic Math.	4	182	322	0.23
	3	140		
Vocational Math.	4	99	153	0.11
	3	54		
Related Math.	4	255	463	0.33
	3	208		
Arithmetic	4	57	97	0.07
	3	40		
Consumer's Math.	4	87	139	0.10
	3	52		
Technical Math.	4	316	340	0.24
	3	24		
Algebra-Geometry	4	51	430	0.31
	3	379		
Others	4	979	1795	1.28
	3	816		
Total in	4	46527		
Total in	3	19044		
Total			65571	46.7

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[a] Type of school refers to the four and three year high schools.

TABLE XIV
MATHEMATICS COURSE SELECTIONS OFFERED WITHIN THE SCHOOLS

Course Selections		Group								Sub Tot.		Tot.
		I		II		III		IV				
	Type[a]	3	4	3	4	3	4	3	4	3	4	
(1)Algebra I, Plane Geometry, Algebra II, Solid Geometry &/or Trigonometry		6	9	1	13		9		12	7	43	50
(2)Less than (1)		2	2		1	1	8		9	3	21	24
(3)Less than (1) but with Specialized Math.		2		1						3		3
(4)Less than (1) but with General Math.			1	1			2		2	1	5	6
(5)Less than (1) but with Review Math.		2	4		5		5		8	2	22	24
(6)Less than (1) but with some other course than in (3), (4), or (5)		1		1			1					
(7)Less than (1) but with more than one other course		2	2	3	3		4		3	5	12	17
(8)All of (1) and Specialized Math.		2	1	1	4		1			3	6	9
(9)All of (1) and General Math.			8		13		5		6		32	32
(10)All of (1) and Review Math.		4	5	1	2		10	1	2	6	19	25
(11)All of (1) but with some other course than in (3), (4), or (5)		1	2		1		2			1	5	6
(12)All of (1) and any two other courses		6	14		9		3		2	6	28	34
(13)All of (1) and any three other courses		4	9		1					4	10	14
(14)All of (1) and more than four other courses		3	6							3	6	9
Totals		35	63	9	52	1	51	1	44	46	210	256

[a] Type of schools refers to the three and four year high schools.

mathematics. Under general mathematics, practical, consumers', applied, basic, everyday, essentials of, social, and survey mathematics were included.

Observations. In Table XI, "Number of Schools Offering the Different Mathematics Courses," the following facts were evident:

1. The courses which the most schools offered were algebra I, plane geometry, algebra II, and solid geometry and trigonometry.
2. The courses technical mathematics, algebra-geometry, and vocational mathematics were offered only in Group I.
3. In the three year schools plane geometry was offered by the most schools.

The resulting tabulation of Table XII, "When Mathematics Courses Are Offered," brought out the following information:

1. It is interesting to note that the total numbers of mathematics courses for the tenth and for the eleventh grades were identical.
2. The number of courses offered in the twelfth grade was greater than in any other grade.
3. Algebra I was most frequently offered in the ninth grade, plane geometry in the tenth, algebra II in the eleventh, and solid geometry and trigonometry in the twelfth.
4. The second most common courses in each grade were general mathematics in the ninth grade, algebra I in the tenth grade, plane geometry in the eleventh grade, and

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algebra II in the twelfth grade. In the twelfth grade review mathematics had only two courses less than algebra II.

5. In the three and four year high schools of Group I algebra I, algebra II, plane geometry, general mathematics, practical mathematics, related mathematics, and shop mathematics were offered in every grade at least once. In the three and four year high schools of Group II this was true for algebra II and shop mathematics. Group III offered at least once in the four year high schools plane geometry, review mathematics, and shop mathematics, and in the three year high schools basic mathematics.

A study of Tables XIII A and B, "Group Totals of School Population and Number of Pupils in Each Mathematics Course," and "Total Number of Pupils and Per Cent of High School Population in Each Mathematics Course," revealed these points:

1. Trigonometry and algebra-geometry when offered in the three year schools in Group I had more pupils than the same courses in the four year schools in Group I.

2. The five most populous courses in the schools of this survey were plane geometry (.1269), algebra I (.1145), algebra II (.0926), solid geometry and trigonometry (.0249), and general mathematics (.0229).

3. In all the four year high schools in this study about 48 per cent of the pupils were taking some form of mathematics. In all the three year high schools about 43 per cent of the pupils were taking mathematics. There were 46.7 per cent of the total school population in mathematics courses.

4. In Group IV slightly more than 50 per cent were enrolled in mathematics courses.

5. The least populous courses were arithmetic (.0007), consumer's mathematics (.0010), vocational mathematics (.0011), and advanced mathematics (.0013).

A study of Table XIV, "Mathematics Course Selections Offered Within the Schools," revealed the following items:

1. The most common course selection is number (1) in the table which included algebra I, plane geometry, algebra II, and solid geometry and/or trigonometry. Next in number was the selection which included the above and two other courses. Following this was selection (1) plus general mathematics.

2. Only a little under 10 per cent of the selections have fewer than the algebra I, plane geometry, algebra II, and solid geometry and/or trigonometry, appearing in number (1) in the table, without some replacement.

3. Of those course selections which have fewer than number (1) in the table and which have a replacement, the most common one is review mathematics.

4. Group I has the largest selection of courses. Forty-three per cent of their courses of study had two or more courses besides the basic courses in number (1). All the other groups of schools in this category amounted to 9.5 per cent of their total number of schools.

In this chapter, first, the data on mathematics organizations has been presented in Table V and observations made from the information. Second, the data on courses offered has been presented in Tables VI, VII, VIII, and IX, and the significant facts noted.

CHAPTER IV

INTERPRETATIONS, CONCLUSIONS, AND RECOMMENDATIONS

I. INTERPRETATION OF THE DATA ON TEACHERS

Comparison of teachers' salaries, length of service, and preparation. In all phases of this topic it was evident that men received substantially higher salaries than women. This was true even when the degrees and the length of service were not taken into consideration. The case of the highest paid woman in the over forty year group receiving less than one of the men in the zero to four year group, both with a bachelor's degree, showed vividly the inequality between the salaries of the sexes in teaching. Furthermore, there were more women teachers than men in the lower salary intervals, and far more men than women in the upper intervals.

The oldest and youngest teachers in point of service had fewer academic degrees than those in the middle group. This indicates that emphasis in recent times has been on obtaining academic degrees in order to advance in the teaching profesion. The older teachers who are established in more or less permanent positions have not felt it worthwhile to get these degrees.

The increase in the higher salary ranges of the ratio of the number of teachers in Group I (the largest schools), to the number of teachers in the other groups could indicate the movement of teachers from rural to urban areas to obtain a better living wage.

As previously mentioned, The New York Times[1] reported the average annual salary in the United States for 1946-47 as $2,026. Massachusetts mathematics teachers received an average (arithmetic mean) salary of $2,936. This was $910 more than the national average for all teachers. According to this, Massachusetts mathematics teachers are fairly well paid.

Just as there are more male infants than female at birth and just as the males have a higher death rate, which eventually results in more women than men, such is the case for the mathematics teacher. The fact that with length of service the number of women teachers increased in relation to the number of men teachers showed not only that the men probably die younger than the women, but also that women had a greater tendency to stay in the teaching of mathematics. This is confirmed by the difference in the average length of service for men and women. The average (arithmetic mean) length of service for men was twelve years and for women, twenty years. This difference is probably due in part to the greater mobility and the greater number of opportunities for men. This reduction of the men in the longer service groups brought about an equalization of the number of men and women teachers of mathematics.

Schools of all sizes had about the same number of mathematics teachers in the lowest pay group. Therefore, the lowest

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[1] Fine, B., Survey comparing 1947-48 status with 1946-47 revised, item in The New York Times, January 4, 1948, IV, 9:1.

salaries are not strictly confined to either the small or the large schools.

The men had a greater percentage of master's degrees. This is no doubt a contributing factor to the higher salaries of men.

Teaching combinations. The larger schools had more teachers who taught only mathematics, and the smaller schools had more teachers who taught mathematics and science. This is a matter of expediency because the smaller school cannot afford to hire a separate teacher for each subject.

The order in which the dual combinations with mathematics appeared were science, social studies, English, commercial subjects, and foreign languages. Science would be expected to come first. That social studies might come next was suggested in a statement by Langer.[2] He said that a poll conducted at the University of Wisconsin indicated that mathematics was a requisite for serious study in astronomy, biology, chemistry, commerce, economics, geology, mathematics, medicine, pharmacy, physics, physical geography, philosophy, political science, psychology, and sociology. Langer, commenting on these courses, said, "The inclusion of so many social studies in this list of fields in which mathematics is needed will not, I venture to suppose, have been entirely expected by everyone."[3]

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[2] Langer, R. E., "Mathematics in Modern Education," School and Society, 41:692, 693, May, 1935.

[3] Ibid., p. 693.

The teachers with combinations of four different courses which are not all in any one field would have to have above average cultural background and education to teach so many courses.

The evidence on teaching combinations of the principals and vice-principals points to the active participation of the mathematics teacher in the administration of the schools. Mathematics teachers were principals in a little under 25 per cent of all the public high schools of Massachusetts.

Teaching load. The average number of periods per week was twenty for men, twenty-two for women, and twenty-one for both. This indicated that the women carried slightly heavier programs than the men. Though the average number of periods per day for both men and women was less than five, the average of the number of different classes per day for both men and women was five, as would be expected. The range of teaching periods for the mathematics teacher was from one to thirty-nine periods per week. The range of the daily number of classes was from one to nine. The larger numbers of classes and periods would mean a great deal of preparation for some teachers.

The range for the number of classes of more than thirty was from one to eight. The author doubts the sobriety of the individual who filled out the questionnaire on the mathematics teacher who had eight classes of more than thirty. That there were more than thirty pupils in 22 per cent of the mathematics teacher's classes is not conducive to the teacher's considera-

tion of the individual differences of his pupils. This was especially true for one male teacher who had fifty to fifty-nine pupils in one of his classes.

Mathematics teachers averaged 112 pupils for men, 122 pupils for women, and 116 pupils for both. Again the women suffered from discrimination.

II. INTERPRETATION OF THE DATA ON COURSES

Mathematics organizations. In spite of all the good publicity and work which mathematics personnel have put into mathematics organizations, only 5 per cent of all the schools in Massachusetts had them. This might indicate lack of initiative on the part of the individual mathematics teacher. It also is probably due in part to the preference of pupils to spend extra-curricular time in sports and social organizations.

Courses offered. The number of pupils in each course decreased steadily from grades ten to twelve in the courses most commonly offered: algebra I (ninth grade), plane geometry (tenth grade), algebra II (eleventh grade), and solid geometry and trigonometry (twelfth grade).

With the greater variety of courses offered in grade twelve, it is shown that attention was given to offering the pupil the type of mathematics he would need to use when he left high school.

General mathematics was next to solid geometry and trigonometry in popularity. This showed that an attempt was made to satisfy the needs of the pupils not going to college.

Only a little under 10 per cent of the high schools offered fewer than the traditional four courses. With a subject which claimed less than 50 per cent of the school population, this showed adequate coverage.

The second most popular courses in grades nine to twelve indicate that some schools believed in delaying the study of certain mathematics courses until the later years of high school, as was suggested by Wrinkle.[2]

III. CONCLUSIONS

The teacher (in Massachusetts).

1. Massachusetts appears to be a comparatively good place to teach mathematics, because the average salary, $2,936, was well above the national average, $2,026, for 1946-47.

2. Because the number of teachers with a master's degree is nearly half of all teachers of mathematics of both sexes, and since the master's degree is dominant in the higher salary groups, it would appear wise for the beginning teacher to plan on attaining this degree to insure future advancement.

3. If a higher salary is the teacher's main objective, he will do well to look towards the larger schools for the realization of this goal. For beginning teachers, however, the larger schools do not pay more than the smaller schools;

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[2] Wrinkle, W. L., "Mathematics in the Modern Curriculum for Secondary Education," The Mathematics Teacher, 29:376, 1936.

both have about the same number in the lower salary ranges.

4. The prospective teacher of mathematics would be wise to be prepared to teach some other subject, probably science, especially to start in the smaller schools. Many more teachers in these schools taught a combination with mathematics, usually mathematics and science. His choice of a combination, however, is not limited to science since there are mathematics teachers who taught social studies, English and other subjects.

5. Future teachers will be interested to compare the teaching loads of positions offered with the average figures for Massachusetts: average (arithmetic mean), twenty-one periods per week, five classes a day, between thirty and forty in the largest class, and 116 pupils in all.

6. Smaller schools have lighter teaching loads than large ones, but teachers have more extra assignments.

Courses (in Massachusetts).

1. The courses which a beginning mathematics teacher might be expected to teach in each grade are represented by the following facts giving the first and second most common courses in each grade: algebra I or general mathematics in grade nine, plane geometry or algebra I in grade ten, algebra II or plane geometry in grade eleven, and solid geometry and trigonometry in grade twelve. A greater variety of courses other than those mentioned above would be offered in the larger high schools.

2. The beginning teacher might be interested in the per cent of the high school population in the different mathematics courses in order to get an idea of the comparative size of each course. The survey indicates that the five most populous courses in the high schools were plane geometry (.1269), algebra I (.1145), algebra II (.0926), solid geometry and trigonometry (.0249), and general mathematics (.0229).

3. There were 46.7% of all the pupils in the high school taking mathematics. Therefore, all the mathematics teachers together would teach nearly half of the school population each year.

4. The traditional course selection - algebra I, plane geometry, algebra II, and solid geometry and trigonometry - was still the most common, although there were many other selections that included other additional courses.

5. Since mathematics teachers were active in the administrative aspect of education, it would be well for the mathematics teacher to have some preparation along administrative lines. The prospects for advancement from teaching alone to administrative positions seem especially good for the teacher of mathematics.

IV. RECOMMENDATIONS FOR THE IMPROVEMENT OF THE SURVEY FORM

In the column "Years of preparation" there is a need for a more uniform way of reporting the amount of graduate study.

Semester hours credit toward the next degree would be the most effective since progress toward a degree could be noted.

The population in mathematics courses showed that a greater percentage of the high school population was taking general mathematics than review mathematics. Since review mathematics appears on the questionnaire but general mathematics does not, the ease with which the questionnaire could be filled out would be increased if the name "General Mathematics" were put in the column called "Name of course."

The column "Other assignments" for teachers could be made more definite by either allowing room for a list of assignments (which some schools included in extra space elsewhere) or by substituting "Number of assignments" at the head of the column. The answers given in this column in the 1946-47 survey were too vague and varied to be useful for study in this thesis.

V. SUGGESTIONS FOR FURTHER STUDY IN EDUCATION

1. It would be interesting to find the number of principals and vice-principals who taught subjects other than mathematics.

2. Results of analyses of future biennial surveys can be compared with those of this thesis.

3. This thesis can be used as a model for the analysis of the other subject fields.

4. An investigation of the part time teachers of mathematics would be interesting.

5. An analysis of the subject matter in the mathematics courses named in the survey is suggested.

6. A study could be made of the comparison between the influence of preparation and length of service on salary.

7. An analysis could be made of the other assignments of mathematics teachers such as guidance, coaching, etc.

CHAPTER V

ABSTRACT OF THE THESIS

Statement of the problem. The purposes of this thesis were (1) to use the biennial high school survey for 1946-47 conducted by the Massachusetts Department of Education in order to obtain a clear picture of mathematics teaching in Massachusetts in that year; (2) to make observations and interpretations of this data, and to draw conclusions which might be of assistance to those who are responsible for preparing the teachers of tomorrow and to anyone connected with mathematics teaching; and (3) to make recommendations for the improvement of the part of the survey concerned with mathematics.

Since 1916, these biennial surveys by the Massachusetts Department of Education have been conducted, and the current questionnaires, filled out by the high school principals and superintendents, have been on file in the office of the Supervisor of Secondary Education for Massachusetts. There has been little active use made of the surveys, which have been available to anyone who had a professional interest in the information they contain. Unless some real use and interpretation is made of this data, the author feels it is a waste of the taxpayers' money and the school officials' time to conduct the survey.

Methods and procedures. Two mimeographed forms, parts A and B of the Appendix, were used to record the material in the survey relevant to mathematics. This material was divided for

this thesis into two parts. First was considered that information concerning the mathematics teacher: salaries, length of service, academic preparation, teaching combinations, and teaching loads. Tables were compiled on each of these subjects and observations and comparisons were made.

Second, the data on mathematics courses was studied. This was concerned with mathematics organizations, course selections, years courses were offered, per cent of school population in different courses, and the number of schools offering the different courses. From this information tables were compiled and observed. Previous studies on related subjects were used for background and comparison.

Summary of findings. After the data was presented on the mathematics teacher and the courses offered, interpretations were made to show the significance of the information recorded. From these interpretations conclusions were drawn which might be of assistance to teachers and prospective teachers of mathematics and to anyone concerned with the subject. Men had substantially higher salaries than women, more education, shorter average length of service, and somewhat lighter teaching loads. Massachusetts had an average salary well above the national average. Larger schools offered the highest salaries. A master's degree is necessary for future advancement. The average teaching load for Massachusetts teachers was twenty-one periods per week, five different classes, between thirty and forty in the largest class, and 116 pupils in all. Since mathe-

matics and science were the most common teaching combinations, preparation in science would be helpful to the mathematics teacher. That nearly 25 per cent of all the principals taught mathematics indicates that the opportunities are good for mathematics teachers to advance to administrative positions.

Mathematics organizations were not popular in Massachusetts. All except about 10 per cent of Massachusetts high schools offered at least the traditional course selection: algebra I in grade nine, plane geometry in grade ten, algebra II in grade eleven and solid geometry and trigonometry in grade twelve. Of all the high school pupils, 46.7% were taking some form of mathematics. Plane geometry was the most populous course. Grade twelve offered the greatest variety of courses.

Suggestions were made for the improvement of the survey by making the column headings more specific.

Recommendations were included for further study in the field of education on the principals and vice-principals, comparison of future survey results, analysis of other fields of the survey, part time teachers, material offered in the courses, other assignments of mathematics teachers, and the comparative influence of preparation and length of service on salary

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APPENDIX A

School Population
______________________, High School, ____________________, Massachusetts

XI. MATHEMATICS TEACHING STAFF

Sex

1. Teacher (Full Time)	Salary	Yrs. Previous Experience	Yrs. in this School	Teaching Periods Per. Wk.	Other Assignments	No. of Classes	No. of Classes of 30 or more	No. in largest Class	Total No. in all Classes	Yrs. of Prep			Degrees Held	Fields in which teacher has classes
										In College	In Teacher's College	In Graduate Study		
1.														
2.														
3.														
4.														
5.														
6.														
7.														
8.														
9.														
10.														
11.														

2. Persons Employed - (Part Time)	Salary	Yrs. Previous Experience	Yrs. in this School	Teaching Periods Per Week	Other Assignments	No. of Classes	No. of Classes of 30 or more	No. in largest Class	Total No. in all classes	Yrs. Of Prep.			Degrees Held	
										In College	In Teacher's College	In Graduate Study		
1.														
2.														
3.														
4.														
5.														
6.														

IX. Pupil math organizations.

Name	Membership	Meetings per yr.	Credit

X. Math Courses

Name	Yr. intended	Per. per wk.	No. of wks. if less than year	No. of pupils
Algebra I				
Algebra II.				
Plane Geom.				
Review Math				
Solid Geom.				
Trigonometry				
Mech. Drawing				
Shop Math				

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